

and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

The low-voltage distribution switchboards and all components shall be designed, manufactured and tested in accordance with the latest applicable following standards:

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA PB 2 (1995) Deadfront Distribution Switchboards

UNDERWRITERS LABORATORIES (UL)

UL 891 (1998) Dead-Front Switchboards

1.3 SUBMITTALS

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control. Include a columnar list of appropriate products and tests beneath each submittal description.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy,

Air Force, and NASA projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy, Air Force, and NASA projects.

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

The following information shall be submitted to the engineer for review/approval:

Master Drawing Index
Front View Elevation
Floor Plan
Top View
Single Line
Schematic Diagram
Nameplate Schedule
Component List
Conduit entry/exit locations
Assembly Ratings Including:
Short-circuit rating
Voltage
Continuous Current
Major Component Ratings Including:
Voltage
Continuous Current
Interrupting Ratings
Cable Terminal Sizes

Where applicable, the following information shall be submitted to the Engineer:

Busway Connection
Connection details between close-coupled assemblies
Composite floor plan of close-coupled assemblies
Key interlock scheme drawing and sequence of operations

Submit four (4) copies of the above information.

SD-07 Certificates

The manufacturer of the assembly shall be the [manufacturer of circuit protective devices](#) within the assembly.

For the equipment specified herein, the manufacturer shall be ISO 9000, 9001, or 9002 certified.

The manufacturer of this equipment shall have produced similar electrical equipment for a minimum of five (5) years. When requested by the Engineer, an [acceptable list of installations](#) with similar equipment shall be provided demonstrating compliance with this requirement.

The switchboard shall be suitable for and certified to meet all applicable [seismic requirements](#) of [Uniform Building Code (UBC)] [the California Building Code (CBC)] for zone 4 application. Guidelines for the installation consistent with these requirements shall be provided by the switchgear manufacturer and be based upon testing of representative equipment. The test response spectrum shall be based upon a 5% minimum damping factor, [UBC: a peak of 0.75g, and a ZPA of 0.38g] [CBC: a peak of 1.8g, and a ZPA of 0.45g]. The tests shall fully envelope this response spectrum for all equipment natural frequencies up to at least 35Hz.

[SD-08 Manufacturer's Instructions](#)

Ten(10) copies of the equipment operation and maintenance manuals shall be provided.

Operation and maintenance manuals shall include the following information:

- [Instruction books and/or leaflets](#)
- [Recommended renewal parts list](#)

[SD-11 Closeout Submittals](#)

The following information shall be submitted for record purposes:

- [Final record drawings](#) and information for items listed in SD-01.
- [Wiring Diagrams](#)
- [Production test](#)
- [Installation Information](#)
- [Seismic certification and equipment anchorage details](#)

1.4 PRE CONSTRUCTION AND REGULATORY REQUIREMENTS

The low-voltage switchboard shall be UL labeled. Prior to commencement of construction, the Subcontractor must submit the following for review/approval:

- [Master Drawing Index](#)
- [Front View Elevation](#)
- [Floor Plan](#)
- [Top View](#)
- [Single Line](#)
- [Schematic Diagram](#)
- [Nameplate Schedule](#)
- [Component List](#)
- [Conduit entry/exit locations](#)
- [Assembly Ratings Including:](#)
 - [Short-circuit rating](#)
 - [Voltage](#)
 - [Continuous Current](#)
- [Major Component Ratings Including:](#)
 - [Voltage](#)
 - [Continuous Current](#)
 - [Interrupting Ratings](#)
 - [Cable Terminal Sizes](#)

Where applicable, the following information shall be submitted to

the Engineer:

Busway Connection
Connection details between close-coupled assemblies
Composite floor plan of close-coupled assemblies
Key interlock scheme drawing and sequence of operations

Submit four (4) copies of the above information.

1.5 DELIVERY, STORAGE AND HANDLING

Equipment shall be handled and stored in accordance with manufacturer's instructions. One(1) copy of these instructions shall be included with the equipment at the time of shipment.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURER

Cutler-Hammer or equal.

2.2 RATINGS

The assembly shall be rated to withstand mechanical forces exerted during short-circuit conditions when connected directly to a power source having available fault current [of (65,000)(100,000) amperes symmetrical at rated voltage] [as shown on the drawings].

Voltage rating to be as indicated on the drawings.

2.3 CONSTRUCTION

Switchboard shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides and rear shall be covered with removable bolt-covers. All edges of front covers or hinged front panels shall be formed. Provide adequate ventilation within the enclosure.

All selections of the switchboard shall be front and rear aligned with depth as shown on drawings. All protective devices shall be group mounted. Devices shall be front removable and load connections front and rear accessible. Rear access shall be provided.

All sections of the switchboard shall be rear aligned with depth as shown on the drawings. All protective devices shall be group mounted. Devices shall be front removable and load connections front accessible enabling switchboard to be mounted against a wall.

OR

All sections of the switchboard shall be front and rear aligned with depth as shown on drawings. All protective devices shall be group mounted. Devices shall be front removable and load connections front and rear accessible. Rear access shall be provided.

The assembly shall be provided with adequate lifting means.

The switchboard shall be equal to Cutler-Hammer type Westinghouse Pow-R-Line C utilizing the components herein specified and as shown on the

drawings.

The switchboard shall be suitable for use as service entrance equipment and be labeled in accordance with UL requirements.

2.4 BUS

All bus bars shall be silver-plated copper with bus density @ 1000 amps per sq. inch. Main horizontal bus bars shall be mounted with all three phases arranged in the same vertical plane. Bus sizing shall be based on NEMA standard temperature rise criteria of 65 degrees C over a 40 degree C ambient(outside the enclosure).

Provide a full capacity neutral bus where a neutral bus is indicated on the drawings.

A copper ground bus (minimum 1/4 x 2 inch), shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the switchboard.

All hardware used on conductors shall be high-tensile strength and zinc-plated. All bus joints shall be provided with conical spring-type washers.

2.5 WIRING/TERMINATIONS

Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be furnished as required. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.

Mechanical-type terminals shall be provided for all line and load terminations suitable for copper or aluminum cable rated for 75 degrees C of the size indicated on the drawings.

Lugs shall be provided in the incoming line section for connection of the main grounding conductor. Additional lugs for connection of other grounding conductors shall be provided as indicated on the drawings.

All control wire shall be type SIS, bundled and secured with nylon ties. Insulated locking spade terminals shall be provided for all control connections, except where saddle type terminals are provided integral to a device. All current transformer secondary leads shall first be connected to conveniently accessible short-circuit terminal blocks before connecting to any other device. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips. Provide wire markers at each end of all control wiring.

2.6 MOLDED CASE PROTECTIVE DEVICES

[Main] [Tie] [Feeder] protective devices shall be molded case circuit breakers with inverse time and instantaneous tripping characteristics and shall have ground fault protection where indicated or as required by NEC. Molded case breakers shall be Cutler-Hammer type Westinghouse Series C or approved equal.

Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make/quick-break over-center switching mechanism that is mechanically

trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position. Contacts shall be nonwelding silver alloy, and arc extinction shall be accomplished by means of DE-ION arc chutes. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.

Circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the drawings.

Where indicated circuit breakers shall be UL listed for series applications.

Where indicated circuit breakers shall be current limiting.

Circuit breakers [150-][250-][400-][600-] ampere frame and below shall be Cutler-Hammer type Westinghouse Series C with thermal-magnetic trip units and inverse time-current characteristics.

Circuit breakers [400-][600-] ampere through 1200-ampere frame shall be Cutler-Hammer type Westinghouse Series C with microprocessor-based RMS sensing trip units.

Circuit breakers 1600-ampere through 2500-ampere frame shall be Cutler-Hammer type Westinghouse Series C with microprocessor-based RMS sensing trip units.

Where indicated, provide circuit breakers UL listed for application at 100% of their continuous ampere rating in there intended enclosure.

2.7 ACCESSORIES

Provide shunt trips, bell alarms and auxiliary switches as shown on the contract drawings.

Centralized local monitoring.

Provide transient voltage surge suppression.

2.8 MISCELLANEOUS DEVICES

Key interlocks shall be provided as indicated on the drawings.

Control power transformers with primary and secondary protection shall be provided, as indicated on the drawings, or as required for proper operation of the equipment. [Control power transformers shall have adequate capacity to supply power to the transformer cooling fans.]

Each section of the switchboard shall be provided with a space heater [thermostatically controlled]. Power for the space heaters shall be obtained [from a control power transformer within the switchboard] [from a source as indicated on the drawings]. Supply voltage shall be [120] [240] volts AC.

2.9 UTILITY METERING

Where indicated on the drawings, furnish separate barriered-off Utility Metering Compartment complete with hinged sealable door. Bus work shall include provisions for mounting utility company current transformers and potential transformers or potential taps as required by the utility company. Provide Service Entrance Label and provide necessary applicable

service entrance features per NEC and local code requirements.

2.10 CUSTOMER METERING

Where indicated on the drawings, provide a separate customer metering compartment with front hinged door and include the following:

Current transformers for each meter. Current transformers shall be wired to shorting-type terminal blocks.

[Potential transformers including primary and secondary fuses with disconnecting means] [Fused potential taps as the potential source] for metering as shown on the drawings.

Microprocessor-Based Metering System

2.11 ENCLOSURES

Outdoor enclosure shall be non-walk-in and meet applicable NEMA 3R [UL 891](#) and [NEMA PB 2](#), dead front construction requirements. NEMA 1 enclosed structure mounted in stainless steel house will not be acceptable.

Enclosure shall have [flat roof] [sloping roof downward toward rear].

Outer sections shall be the same widths as indoor structures, except each end of the outdoor assembly shall have an end trim.

The enclosure shall be provided with [bolt-on rear covers] [rear-hinged doors] for each section.

Doors shall have provisions for padlocking.

Ventilating openings shall be provided [complete with replaceable fiber glass air filters].

Provide space heaters [thermostatically controlled] for each structure with adequate wattage to prevent the accumulation of moisture.

Power for space heaters, lights and receptacles shall be obtained from a [control power transformer within the switchboard] [source as indicated on the drawings]. Supply voltage shall be [120] [240] volts AC.

2.12 NAMEPLATES

Engraved nameplates, mounted on the face of the assembly, shall be furnished for all main and feeder circuits as indicated on the drawings. Nameplates shall be laminated plastic, black characters on white background. Characters shall be 3/16-inch high, minimum. Nameplates shall give item designation and circuit number as well as frame ampere size and appropriate trip rating. Furnish master nameplate giving switchboard designation, voltage ampere rating, short-circuit rating, manufacturer's name, general order number, and item number.

Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.

2.13 FINISH

All exterior and interior steel surfaces of the switchboard shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Finish of exterior switchboard shall be polished 304 Stainless Steel.

PART 3 EXECUTION

3.1 FACTORY TESTING

The following standard factory tests shall be preformed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.

The switchboard shall be completely assembled, wired, adjusted, and tested at the factory. After assembly, the complete switchboard will be tested for operation under simulated service conditions to assure the accuracy of the wiring and the functioning of all equipment. The main circuits shall be given a dielectric test of 2200 volts for one(1) minute between live parts and ground, and between opposite polarities. The wiring and control circuits shall be given a dielectric test of 1500 volts for one(1) minute between live parts and ground.

The manufacturer shall provide three (3) certified copies of factory test reports.

The factory tests outlined above shall be witnessed by the owner's representative.

The manufacturer shall notify the owner two (2) weeks prior to the date the tests are to be preformed.

The manufacturer shall include the cost of transportation and lodging for up to three (3) owner's representatives. The cost of meals and incidental expenses shall be the owner's responsibility.

3.2 INSTALLATION

The Subcontractor shall install all equipment per the manufacturer's instructions, including [Installation Information](#), contract drawings and National Electrical Code.

The assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted directly to [Subcontractor supplied floor sills provided the floor is level to 1/8-inch per 3-foot distance in any direction]. All necessary hardware to secure the assembly in place, including [Seismic certification and equipment anchorage details](#), shall be provided by the Subcontractor.

3.3 FIELD ADJUSTMENTS and CLOSEOUT SUBMITTALS

The Subcontractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short-circuit study, protective device evaluation study and protective device coordination study.

Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with an approved short circuit and protective device coordination study shall be carried out by the

Subcontractor at no additional cost to the owner.

Upon completion of all testing and final field adjustments, Subcontractor must submit the following:

- record drawings and information for items listed in SD-01.
- Wiring Diagrams
- Production test
- Installation Information
- Seismic certification and equipment anchorage details

3.4 MANUFACTURER'S CERTIFICATION

A certified test report of all standard production tests shall be available to the Engineer upon request. Subcontractor must provide the following to Engineer/Owner: Instruction books and/or leaflets, Recommended renewal parts list.

3.5 TRAINING

The Subcontractor shall provide a training session for up to [____] Owner's Representatives for [____] normal workdays at a jobsite location determined by the owner.

The training session shall be conducted by a manufacturer's qualified representative. The training program shall consist of instruction on operation of the assembly, circuit breakers, fused switches, and major components within the assembly.

-- End of Section --